CORNELL UNIVERSITY

AGRICULTURAL EXPERIMENT STATION OF

THE COLLEGE OF AGRICULTURE

Department of Dairy Industry

METHODS OF MAKING SOME OF THE SOFT CHEESES

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For a number of years the Department of Dairy Industry at the New York State College of Agriculture has been making a study of the methods of manufacture of the commoner varieties of soft cheeses, with the object of ascertaining the method that will give the best product for each variety. Tests have been made of various temperatures for setting the milk, various quantities of acid to be used in the milk when set, various quantities of starter, various quantities of rennet extract, and various methods of holding. The method of manufacture here presented for each kind of cheese is the one that was found to give the best results.

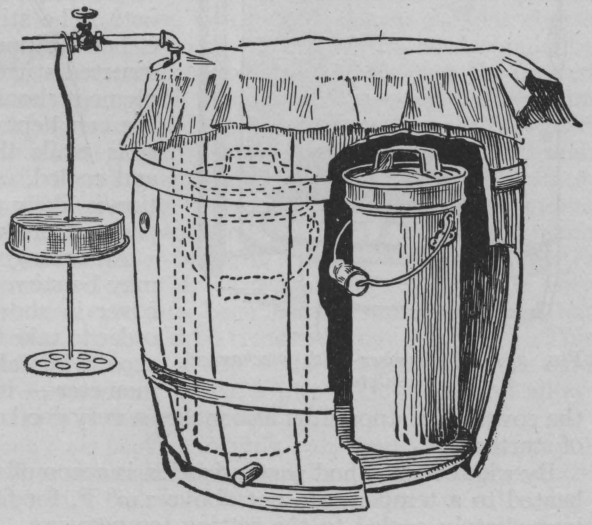

Fig. 22.—*Homemade device for pasteurizing*

There are certain requirements which must be complied with in order that the cheese shall be of prime uniform quality: (1) The cheese must have a good flavor. It can be of no better flavor than the milk from which it is made, and therefore there must be a supply of good milk. (2) The room in which the cheese is made must be so constructed that the temperature can be controlled. This is necessary in order to insure a uniform development of lactic acid. (3) A good, clean starter must be used.[1] The starter not only hastens the development of lactic acid, but also tends

[1] Propagation of starter for butter making and cheese making. By E. S. Guthrie and W. W. Fisk. Circular No. 13, Cornell University Agricultural Experiment Station. (Out of print.)

to correct or overcome bad flavors in the milk. (4) The equipment must include an acid test, by means of which the amount of acid in milk and in whey can be quickly determined at the different stages of manufacture.

PASTEURIZATION

All the soft cheeses can be greatly improved in flavor, body, and texture by pasteurizing the milk. Practically the same results can be accomplished by the use of a homemade pasteurizer as by the improved machines for pasteurizing.

One very easy method of pasteurizing milk, when one of the especially constructed machines is not available and only a small quantity of milk is to be pasteurized, is to cut off the upper part of a barrel and insert a steam pipe in the barrel (Fig. 22). The can of milk to be pasteurized is put into the barrel and the steam is turned on. Care should be taken that the milk is not heated to too high a temperature, and it should be stirred frequently in order to insure even temperature and to prevent a cooked flavor in the product. The stirring may be done with either a dipper or an especially constructed stirrer; in either case the implement should be left in the can and the can kept covered as much as possible while the milk is being heated and cooled, as otherwise contamination is likely to occur. The improved pasteurizers have a mechanical stirrer.

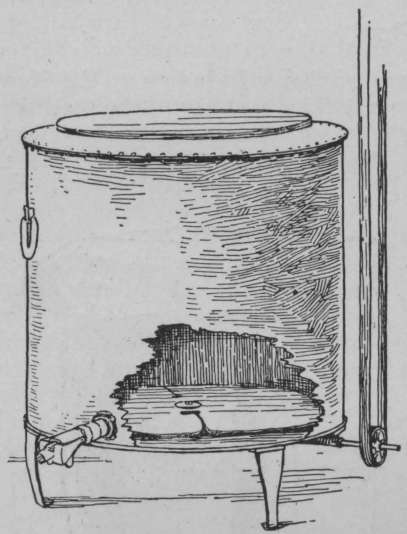

FIG. 23.— *Pasteurizer with mechanical agitator*

An arrangement by which the milk may be stirred without removing the cover is shown in figure 22; but in order to take the temperatu e — which should be taken with a sterile thermometer — it is necessary to remove the cover. This apparatus also makes a very good outfit for the preparation of starter.

By whatever method pasteurization is accomplished, the milk should be heated to a temperature not above 140° F. for fifteen minutes, and then immediately cooled to the setting temperature. If heated to too high a temperature the milk will have a very undesirable cooked flavor and this will be imparted to the cheese.

Pasteurizing the milk tends to overcome the difficulties encountered in making cheese from gassy milk. Also, cheese made from pasteurized milk is much smoother in texture than cheese made from raw milk, and the yield is slightly greater.

The method of manufacture is the same whether or not the milk has been pasteurized, except that less starter is used with pasteurized milk.

POT CHEESE, BAKER'S CHEESE, AND COTTAGE CHEESE

Pot cheese

Pot cheese is the kind of cheese usually made by the housewife by souring skimmed milk on the stove. It is now more extensively made in dairy plants than was formerly the case. By the use of a thermometer and a clean commercial starter, a product more uniform in quality than would otherwise be possible will be obtained.

Method of manufacture.—The skimmed milk as it comes from the separator should be at a temperature of from 85° to 90° F. It should be run into a vat and should not be allowed to cool below 80° F.; held at this high temperature it will sour or thicken much more quickly than if held at a lower temperature. The souring can be accelerated by the use of a starter, which may be added at the rate of from 0.5 to 5 per cent of the skimmed milk used, depending on the amount of starter that can be made. Generally, the more starter that can be added, the more rapid will be the coagulation and the better will be the flavor of the cheese. As soon as the milk has thickened, the curd is ready to be broken up and separated from the whey. This separation is hastened by the application of heat. Usually the temperature of the curd is raised slightly before it is broken up; since this makes the curd firmer, there will be a smaller loss of curd particles in the whey. The curd may be cut with coarse cheddar cheese knives or broken with a rake. The temperature of the curd should be raised very slowly, at least thirty minutes being taken to reach the desired final temperature. No set rule can be given as to the exact temperature to which the curd should be heated. The temperature should be raised until a point is reached at which the curd, when pressed between the thumb and the fingers, will stick together and not go back to the milky state. This temperature is usually from 94° to 100° F., but the cheese maker must use his own judgment in this respect. If the curd is heated too much it will be hard and dry; on the other hand, if it is not heated sufficiently the whey will not separate from the curd and the curd will be very soft and mushy. When the curd has been heated sufficiently and has become firmed in the whey, it should be removed from the whey. This may be done either by letting down one end of the vat and piling the curd in the upper end, or by dipping out the curd into a cloth bag and allowing the whey to drain, which it does very rapidly.

When dry the curd may be packed in milk cans and shipped, or put into cloths and pressed into small bricks weighing about two pounds. It is usually made into cottage cheese, either at the factory or after shipment.

Yield.—The yields obtained in the various tests are shown in table 1. The yield from one hundred pounds of skimmed milk varies from fourteen to nineteen pounds of cheese, as indicated by the table. The table also shows a slightly higher yield for pasteurized milk. The yield varies with the moisture content of the cheese, being in general greater for cheese with a high moisture content. Too much moisture or whey should not be left in the curd, however, as this would render it too soft to be handled.

Qualities of pot cheese.—Pot cheese should have a clean, pronounced, acid flavor. It should be grainy in texture, but free from hard, dry lumps.

Since no attempt is made during the manufacturing process to control the acidity, the cheese will sour or spoil in a short time.

TABLE 1. YIELD OF POT CHEESE FROM PASTEURIZED AND FROM UNPASTEURIZED MILK

Quantity of milk (pounds)	Treatment	Temperature of milk when starter was added (Fahrenheit)	Temperature of curd when dipped (Fahrenheit)	Yield of cheese (pounds)	Pounds of cheese from 100 pounds of milk	Percentage of starter	Condition of cheese
25	Not pasteurized	75°	94°	4.2	17.0	2.0	.....
25		75°	94°	4.0	16.0	2.0	.....
25		70°	94°	4.0	16.0	2.0	.....
29		73°	91°	5.5	18.9	3.0	Very moist
25		76°	94°	3.6	14.4	4.0	Dry
25		76°	96°	3.9	15.6	3.0	Dry
25		76°	100°	3.5	14.0	2.0	Very dry
25		100°	105°	4.0	16.0	1.3	Dry
25		72°	110°	3.5	14.0	5.0	Very dry
23		75°	100°	3.5	15.2	2.0	.....
25		75°	92°	4.2	16.8	1.0	.....
Average, 25.18	.....	.....	.....	.....	15.8	.....	.....
25	Pasteurized at 150° F.	73°	93°	4.5	18.0	0.7	.....
25	150° F.	73°	94°	4.5	18.0	0.7	.....
21	160° F.	75°	94°	4.0	19.0	0.2	Very dry
25	155° F.	75°	108°	4.2	17.0	0.5	Very dry
25	145° F.	76°	94°	4.5	18.0	1.0	.....
25	140° F.	75°	96°	4.5	18.0	1.3	.....
Average, 24.3	.....	.....	.....	.....	18.0	.....	.....

Baker's cheese

Baker's cheese is best made from skimmed milk by the use of commercial starter and rennet extract. This process is longer than that for pot cheese, because it takes longer to get a coagulation and longer for the whey to drain from the curd. The name is due to the fact that the cheese is used to a considerable extent by bakers as filling for pies and cakes.

Method of manufacture.—The milk from the separator should be cooled and held at such a temperature that the acidity will not be above 0.2 per cent at the time when the starter and the rennet are added. If the milk is fresh and sweet when separated it will not have to be cooled below the setting temperature of 75° F. The starter and the rennet should not be added until late in the afternoon, because if they are added too early the coagulation period will be too long. The time from setting to dipping should be about twelve to fifteen hours. At the time when the starter and the rennet are added, the milk should be at a temperature of 75° F.; and this temperature should be maintained until the curd is dipped.

Sufficient starter should be added in the afternoon so that the acidity of the whey separating from the curd the next morning at the time of dipping will be from 0.45 to 0.5 per cent. Generally, from one to three pounds of starter for every thousand pounds of milk is sufficient. The amount of starter to be used depends on the acidity of the milk, the tem-

perature at which the milk is held during the coagulating period, the acidity of the starter, and the length of time allowed for coagulation.

If the milk is too sweet, the starter may be added some time before adding the rennet; usually, however, the rennet is added as soon as the starter has been thoroughly distributed through the milk. The rennet extract should be added at the rate of from one-third to one-half ounce for every thousand pounds of milk. Before it is added to the milk the rennet should be diluted with cold water in the proportion of forty parts of water to one part of rennet extract; this checks the action of the rennet so that it can be evenly mixed with the milk. The action of the starter and the rennet will coagulate the milk in a short time; it should be left undisturbed, however, until the following morning, when the coagulation will be firm and the whey will have begun to separate.

The whey separating from the curd the following morning should have an acidity of from 0.45 to 0.5 per cent. If the acidity is above this amount

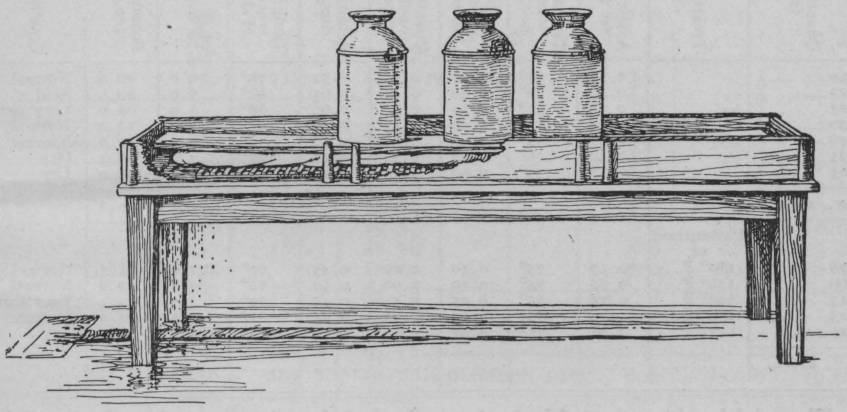

FIG. 24.— *Draining rack, with milk cans full of water used for pressure*

further development should be checked by the addition of salt, since too much acid is very likely to cause an acid cheese; if the acidity has not reached this point, the curd should not be disturbed until it does, as an insufficient amount of acid causes difficulty in separating the curd and the whey.

The separation of curd and whey is best accomplished by dipping them onto a large cloth in a curd sink, allowing the whey to drain away (Fig. 24). The curd should be rolled from the cloth (Fig. 26, page 54), in order that the pieces of curd next to the cloth will not become too dry and also that the whey will have a better opportunity to escape. The expulsion of the whey can be hastened by the application of pressure. This may be brought about by covering the curd with the cloth, placing a board on top of the cloth, and setting cans of water on the board; or the curd may be placed in cheddar-cheese hoops and pressed. The curd should be stirred occasionally so that the particles next to the cloth will not become too dry, as this causes the formation of hard lumps which will not mix with the remainder of the

curd and a lumpy texture results. When sufficiently dry the curd is usually packed for shipment in milk cans or in specially constructed cans.

Yield.—The yield of baker's cheese from pasteurized and from unpasteurized milk is given in table 2. From this table it is seen that pasteurization increases the yield by about two pounds of cheese for one hundred pounds of milk. It is very difficult to compare yields of this cheese because the yield is in proportion to the water content, which varies within wide limits.

TABLE 2. YIELD OF BAKER'S CHEESE FROM PASTEURIZED AND FROM UNPASTEURIZED MILK

Quantity of milk (pounds)	Treatment	Acidity of milk when set (per cent)	Temperature of milk when set (Fahrenheit)	Quantity of starter used (cubic centimeters)	Quantity of rennet used (cubic centimeters)	Acidity of curd when dipped (per cent)	Temperature of curd when dipped (Fahrenheit)	Yield of cheese (pounds)	Pounds of cheese from 100 pounds of milk	Condition of cheese
30	Not pasteurized	0.17	75°	1.00	0.33	0.52	70°	6.0	20.0	Normal
25		0.25	75°	0.50	0.50	0.65	68°	5.0	20.0	Acid
25		0.28	75°	0.50	0.50	0.68	68°	5.0	20.0	Very acid
30		0.22	75°	1.00	0.33	0.43	71°	5.7	19.2	Normal
26		0.18	75°	0.03	0.50	0.47	68°	5.0	19.2	Normal
25		0.19	76°	0.04	0.33	0.45	72°	4.6	18.4	Dry
25		0.18	75°	0.02	0.33	0.46	73°	4.5	18.0	Dry
Av., 26.6									19.3	
478	Pasteurized at 160° F.	0.17	75°	0.10	4.00	0.45	70°	102.0	21.3	Normal
160	156° F.	0.22	75°	0.10	2.00	0.50	72°	34.0	21.2	Normal
13	200° F.	0.15	75°	0.05	0.50	0.45	70°	3.0	23.1	Very soft
25	150° F.	0.20	75°	0.03	0.75	0.45	71°	5.5	22.0	Normal
25	145° F.	0.18	75°	0.04	0.67	0.51	72°	4.5	18.0	Dry
Av., 140.2									21.1	

The yields given in table 3 show the results that may be obtained in actual commercial practice. This table gives the yield of cheese from individual vats for a year, and also the average monthly yield and the total yield for the year.

TABLE 3. YIELD OF BAKER'S CHEESE FOR ONE YEAR FROM INDIVIDUAL VATS

	Pounds of milk used	Pounds of cheese made	Pounds of cheese from 100 pounds of milk		Pounds of milk used	Pounds of cheese made	Pounds of cheese from 100 pounds of milk
March, 1913	700	116.0	16.6	March, 1913 (*continued*)	750	145.0	19.3
	500	86.0	17.2		660	101.0	15.3
	620	97.0	15.6		600	126.0	21.0
	600	98.0	16.3		700	121.0	17.3
	500	79.0	15.8		760	146.0	19.2
	30	5.5	18.3				
	560	98.0	17.5	Total	7,680	1,358.0	
	700	139.5	19.9	Average			17.7

TABLE 3 (*continued*)

	Pounds of milk used	Pounds of cheese made	Pounds of cheese from 100 pounds of milk
April, 1913.....	750	160.0	21.3
	800	169.0	21.1
	850	165.0	19.4
	650	116.5	17.9
	650	142.5	21.9
	650	147.0	22.6
	550	145.5	26.4
	850	163.5	19.2
	650	114.0	17.5
	560	105.0	18.7
	520	138.0	26.5
	750	112.0	14.9
Total.....	8,230	1,678.0	.....
Average.....	.....	.....	20.4
May, 1913.....	600	118.0	19.7
	800	146.0	18.2
	400	78.0	19.5
	850	186.5	21.9
	55	7.0	12.7
	800	188.5	23.6
	800	169.0	21.1
	800	148.0	18.5
	750	108.5	14.5
	850	167.5	19.7
	850	182.0	21.4
	570	105.0	18.4
	850	200.0	23.5
Total.....	8,975	1,804.0	.....
Average.....	.....	.....	20.1
June, 1913.....	800	128.5	16.1
	700	107.5	15.4
	800	160.5	20.1
	560	104.5	18.7
	850	128.0	15.0
	850	168.5	19.8
	800	139.5	17.4
	800	106.0	13.2
	800	153.5	19.2
	800	147.0	18.4
	850	173.5	20.4
Total.....	8,610	1,517.0	.....
Average.....	.....	.....	17.6
July, 1913.....	850	129.0	15.1
	750	114.5	15.3
	800	129.0	16.1
	500	77.5	15.5
	400	78.0	19.5
July, 1913 ..... (*continued*)	550	107.5	19.5
	850	169.5	19.9
	800	159.5	19.9
	800	162.5	20.3
	400	56.0	14.0
	700	119.5	17.1
	700	102.0	14.6
Total.....	8,100	1,404.5	.....
Average.....	.....	.....	17.3
August, 1913...	500	94.5	18.9
	650	137.0	21.1
	600	84.5	14.1
	650	102.0	15.7
	650	81.0	12.5
	700	94.5	13.5
	500	69.0	13.8
	600	108.0	18.0
	580	88.5	15.2
	700	90.0	12.9
Total.....	6,130	949.0	.....
Average.....	.....	.....	15.5
September, 1913	800	152.0	19.0
	600	121.0	20.2
	700	127.0	18.1
	850	149.0	17.5
	700	129.5	18.5
	700	113.0	16.1
	600	113.5	18.9
	500	87.5	17.5
	500	93.0	18.6
	570	102.0	17.9
Total.....	6,520	1,187.5	.....
Average.....	.....	.....	18.2
October, 1913...	250	50.5	20.2
	350	69.5	19.8
	350	38.5	11.0
	850	183.0	21.5
	850	192.0	22.6
	750	172.5	23.0
	800	183.0	22.9
	750	164.0	21.9
	750	148.0	19.7
	700	139.5	19.9
Total.....	6,400	1,340.5	.....
Average.....	.....	.....	20.9

TABLE 3 (*concluded*)

	Pounds of milk used	Pounds of cheese made	Pounds of cheese from 100 pounds of milk		Pounds of milk used	Pounds of cheese made	Pounds of cheese from 100 pounds of milk
November, 1913.	700	159.0	22.7	January 1914... (*continued*)	300	68.0	22.7
	700	156.0	22.3		500	92.5	18.5
	750	154.5	20.6		500	108.5	21.7
	500	96.0	19.2		500	122.0	24.4
	750	146.0	19.5		500	95.5	19.1
	350	64.5	18.4		500	88.0	17.6
	500	92.0	18.4		500	104.0	20.8
	500	86.0	17.2		400	87.5	21.9
	500	103.5	20.7				
Total.....	5,250	1,057.5	.....	Total.....	5,700	1,193.5	.....
Average.....	.....	.....	20.1	Average.....	.....	.....	20.9
December, 1913.	400	54.5	13.6	February, 1914.	800	175.5	21.9
	500	116.5	23.3		500	100.5	20.1
	400	88.0	22.0		800	153.0	19.1
	500	107.5	21.5		800	142.5	17.8
	500	89.0	17.8		500	102.5	20.5
	500	102.0	20.4		460	93.0	20.2
	500	91.0	18.2		90	13.5	15.0
	500	100.0	20.0		478	102.0	21.3
	500	111.5	22.3		550	104.0	18.9
	500	107.0	21.4		300	29.0	9.7
					500	119.5	23.9
Total.....	4,800	967.0	.....	Total.....	5,778	1,135.0	.....
Average.....	.....	.....	20.1	Average.....	.....	.....	19.6
January, 1914..	500	112.5	22.5	Total for year.	82,173	15,591.5	.....
	500	92.5	18.5	Average for year	.....	.....	19.0
	500	109.5	21.9				
	500	113.0	22.6				

The average monthly yield for two years is shown in table 4. Since these figures represent the result of two years of commercial work, they show the variation in yield that may be expected. While the average yield per month varies from 15.5 pounds of cheese for one hundred pounds of milk (in February, 1913, and in August, 1913) to 21.6 pounds of cheese (in September, 1912), nevertheless there is little difference in the average yields for the two years.

Qualities of baker's cheese —Baker's cheese should have a very mild acid flavor. It should be smooth in texture and entirely free from grains and lumps. It will keep for about a week if stored in a cool place.

Cottage cheese

Method of manufacture.—Cottage cheese is very easily made from either pot cheese or baker's cheese. The manufacturing process is the same in either case. The cheese is broken up and salted evenly, two ounces of

TABLE 4. YIELD OF BAKER'S CHEESE, BY MONTHS, FOR A PERIOD OF TWO YEARS

	March		April		May		June		July		August		September	
	1912	1913	1912	1913	1912	1913	1912	1913	1912	1913	1912	1913	1912	1913
Quantity of skimmed milk used (in pounds)	3,310.0	7,680.0	7,750.0	8,230.0	7,590.0	8,975.0	6,150.0	8,610.0	7,500.0	8,100.0	5,650.0	6,130.0	3,650.0	6,520.0
Amount of cheese made (in pounds)	606.0	1,358.0	1,355.5	1,678.0	1,246.5	1,804.0	1,069.5	1,517.0	1,317.5	1,404.5	1,132.5	949.0	790.5	1,187.5
Yield of cheese from 100 pounds of skimmed milk (in pounds)	18.3	17.7	17.5	20.4	16.4	20.1	17.4	17.6	17.6	17.3	20.0	15.5	21.6	18.2

	October		November		December		January		February		Total	
	1912	1913	1912	1913	1912	1913	1913	1914	1913	1914	1912–1913	1913–1914
Quantity of skimmed milk used (in pounds)	5,710.0	6,400.0	6,675.0	5,250.0	4,800.0	4,800.0	6,600.0	5,700.0	7,830.0	5,778.0	73,215.0	82,173.0
Amount of cheese made (in pounds)	1,199.0	1,340.5	1,281.5	1,057.5	991.0	967.0	1,189.0	1,193.5	1,215.0	1,135.0	13,393.5	15,591.5
Yield of cheese from 100 pounds of skimmed milk (in pounds)	20.9	20.9	19.2	20.1	20.6	20.1	18.0	20.9	15.5	19.6	18.3	19.0

salt being used to ten pounds of curd. Cream or butter is usually mixed with the curd, the amount depending on the price to be received for the cheese. Usually, the greater the amount of fat added, the higher will be the price received for the cheese.

Composition.—In table 5 is shown the composition of cottage cheese made by adding heavy cream, testing about 50 per cent fat, to the curd at the rate of one pound of cream for each one hundred pounds of skimmed milk from which the curd was made. The cheese used in Analysis I was taken directly from the refrigerator, so that the exact percentage of fat in the cream was not known. The cream used in the cheese of Analysis II tested 58 per cent fat; that of Analysis III, 50 per cent fat; that of Analysis IV, 50 per cent fat; and that of Analysis V, 42 per cent fat. The table shows that, while the percentage of fat varies somewhat, the percentage of moisture varies between wider limits. The composition of pot cheese and of baker's cheese is about the same as that of cottage cheese, except that the two former cheeses contain only a trace of fat.

TABLE 5. COMPOSITION OF COTTAGE CHEESE

	I	II	III	IV	V	Average
Water	72.8	74.4	74.2	70.9	71.7	72.8
Fat	4.5	3.5	4.0	3.0	3.5	3.7
Protein	16.9	17.5	16.9	20.7	19.5	18.3
Acid (calculated as lactic acid)	2.2	2.0	2.1	2.2	2.0	2.1
Milk sugar	1.8	0.8	1.4	1.2	1.8	1.4
Ash	1.8	1.8	1.4	2.0	1.5	1.7

Marketing.—Cottage cheese is marketed in several different ways. The commonest method of marketing, and by far the cheapest, is to mold the cheese into prints or balls of various sizes and wrap it in parchment paper. If this is to be done, a good practice is to measure each print by an ordinary one-pound butter mold, care being taken that the mold is full and that there are no air spaces in the cheese. The print of cheese can then be cut in two and wrapped, making two half-pound packages—a very desirable size for family use. Paper cut six by eleven inches is required for wrapping packages of this size. The cheese may be put up in paper cartons of various sizes, but these are rather expensive, and are very likely to absorb whey and thereby become so soft that they cannot be handled. In a few cases the cheese is put into glass jelly tumblers, but this is a very expensive method and one not commonly used.

Qualities of cottage cheese.—Cottage cheese should be clean in flavor, resembling fresh butter in this respect. It may or may not be grainy in texture, but it should be free from hard, dry lumps. If it is made from baker's cheese it will be smooth in texture, but if made from pot cheese it will be grainy.

Defects in pot, baker's, and cottage cheese

Pot cheese, baker's cheese, and cottage cheese are liable to the same

kinds of defects. These, with their causes and remedies, may be classified as follows:

I. Defects in flavor
(a) Acid flavors (indicated by sour taste and smell)
Causes
1. Too high acid content of milk used
2. Too long a period from setting to dipping
3. Too much starter
4. Too high a temperature at setting
Remedies
1. Use of sweeter milk
2. Dipping of curd when the whey shows from 0.45 to 0.5 per cent acidity
3. Use of less starter
4. Setting at lower temperature
5. Addition of salt to the curd as soon as it is dipped, in order to check acid development
6. More rapid working of curd
(b) Food flavors (characteristic of the foods eaten by cows)
Causes
1. Access of cows to such foods as turnips, onions, leeks, garlic, weeds, and the like
2. Exposure of milk in an atmosphere where any of these foods are exposed
Remedies
1. Cows must not be allowed to eat the foods named
2. Aëration in pure air will help to remove odors from the milk
(c) Unclean flavors (Under this head may be included any flavors that are not clean or that are foreign to the cheese and not mentioned above. These flavors may be caused in a number of ways. Only the leading causes are mentioned)
Causes
1. Use of a starter of bad flavor
2. Gassy milk
3. Careless milking
4. Use of dirty milk cans
5. Milk not being properly cooled after it is drawn from the cow
6. Dirty factory conditions
Remedies
1. Use of a starter of good flavor
2. A supply of clean milk
3. Cleanliness of everything that comes in contact with the milk

II. Defects in body and texture
(a) Dry and mealy textures (shown by cheese being too hard, firm, dry, and mealy)
Causes
1. Too little moisture in the cheese
2. Too high development of acid
3. Use of too much rennet extract
Remedies
1. Incorporation of more moisture into the cheese
2. Prevention of development of so much acid
3. Use of less rennet extract, and provision for a longer coagulating period
(b) Lumpy texture (shown by hard lumps of various sizes in the cheese)
Causes
1. Uneven drying of the curd
2. Uneven coagulation
3. Too high a temperature during process of manufacture
4. Too much variation in temperature
Remedies
1. Occasional stirring of curd so that it will dry evenly
2. Even mixing of rennet through the milk
3. Provision of a room in which the temperature can be controlled
(c) Soft, pasty texture (shown by cheese being soft and sticky)
Causes
1. Cheese not sufficiently dried
2. Pasteurization of milk at too high a temperature
3. Use of too much cream

Remedies
1. More thorough drying of the curd
2. Pasteurization of milk at a lower temperature
3. Use of less cream

NEUFCHÂTEL CHEESE

As its name indicates, neufchâtel cheese originated in France. It is now extensively made in this country, but by different methods from those originally employed in France. It may be made from either whole milk or partly skimmed milk, pasteurized or unpasteurized.

The secret of success in making neufchâtel cheese, as well as the other varieties of soft cheese, lies in having the temperature and the acidity under control. This cheese has never been successfully made in a vat because the temperature of the curd throughout cannot be controlled. The curd nearest the sides and the bottom of the vat will be colder or warmer, as the case may be, than that in the center of the vat. This will result in uneven coagulation and uneven acid development.

The milk for the manufacture of this cheese must be of a clean flavor. Too much attention cannot be given to the milk, because the flavor is one of the most important characteristics of neufchâtel cheese. The flavor of the cheese can be no better than the flavor of the milk from which it is made. Gassy milk gives the cheese not only a poor flavor, but also a poor body.

Method of manufacture.—The manufacture of neufchâtel cheese is similar to that of baker's cheese. The milk to be used should be placed in tall cans holding about thirty pounds. The temperature of the milk should be brought to 72° F., and the cans should then be placed in a vat or a tank of water of the same temperature. The vat or tank should be filled with cans, so that the cans will not float. If there is a room in which the temperature can be controlled, the cans may be placed in this room and it will not be necessary to set them in water. If the milk is received in the morning and there is danger of a higher development of acidity than 0.2 per cent before setting in the afternoon, the milk should be held cold until it is ready to be set, when it should be warmed.

The milk should be set in the afternoon, and at this time the acidity should be not higher than 0.2 per cent. If the acidity is higher than this, cheese of acid flavor and grainy texture will probably result.

With the milk at a temperature of 72° F., sufficient starter should be added so that on the following morning the whey—from which the curd will have separated—will show 0.35 per cent acidity. To accomplish this will require about one cubic centimeter of commercial starter to thirty pounds of milk. After the starter has been thoroughly mixed with the milk, rennet extract should be added, at the rate of one-half cubic centimeter to thirty pounds of milk. Before adding it to the milk, however, the rennet extract should be diluted in cold water. This should give a firm coagulation, which will draw away slightly from the side of the can, and on the following morning a little free whey will appear on top of the curd. If this whey does not show 0.35 per cent acidity the dipping must be postponed until this degree of acidity has developed.

The curd should be very carefully dipped with a ladle onto a cloth suspended at the four corners, and allowed to drain. The contents of each can should be dipped onto a separate cloth (Fig. 26), so that the curd may

dry evenly. Factory cotton is a good cloth for this purpose, because it is of fine enough weave so that the curd particles will not go through;

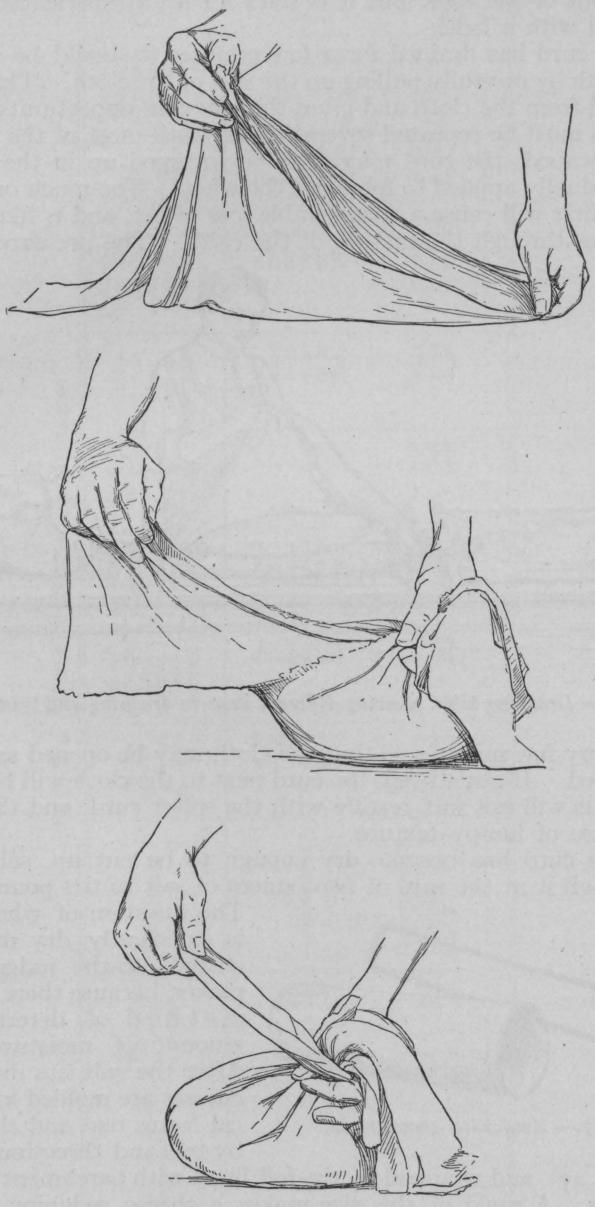

FIG. 25.—*Steps in tying the cheese*

ordinary cheesecloth cannot be used without a considerable loss of curd particles. The curd should not be broken too fine in dipping, as this

prevents the whey from separating rapidly and there will be a greater loss of fat than is necessary. If care is taken not to break the curd it may be poured out of the cans, but it is safer for an inexperienced person to dip the curd with a ladle.

After the curd has drained for a few minutes it should be rolled loose from the cloth by carefully pulling up the side of the cloth. This separates the dry curd from the cloth and gives the whey an opportunity to escape. This process must be repeated several times, until most of the visible free whey has escaped; the curd may then be wrapped up in the cloth, and pressure gradually applied to force out the whey. Too much or too heavy pressure at first will cause a considerable loss of fat, and is likely to force curd particles through the meshes of the cloth. The pressure should be

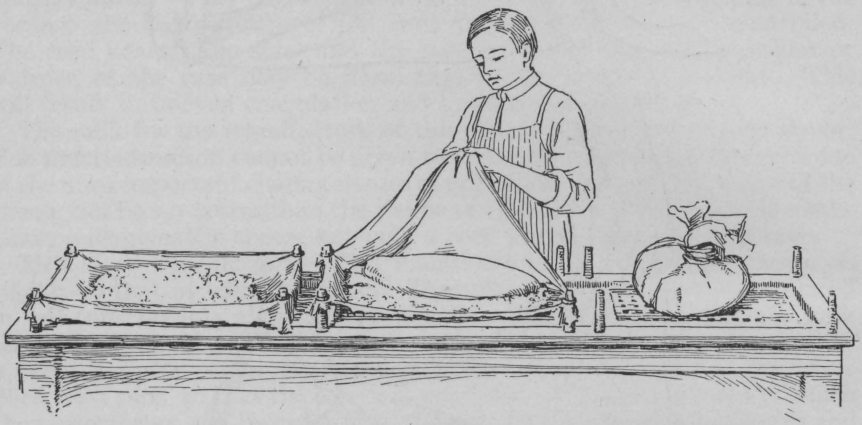

FIG. 26.—*Draining table, showing different steps in draining and tying cheese*

removed every few minutes so that the cloth may be opened and the curd may be stirred. If not stirred, the curd next to the cloth will become very dry so that it will not mix readily with the softer curd, and this will produce a cheese of lumpy texture.

When the curd has become dry enough to be put up, salt is evenly mixed through it at the rate of two ounces of salt to ten pounds of curd. The question of when the curd is sufficiently dry must be left entirely to the judgment of the maker, because there is no quick method of determining the amount of moisture in curd. After the salt has dissolved, the cheeses are molded into cylindrical forms one and three-fourths by two and three-fourths inches in size (Fig. 27), and wrapped in tin foil lined with parchment cut five by seven inches. A mold of this size makes a cheese weighing about one-fourth pound. The cheeses are then packed in wooden boxes, twenty-five cheeses in a box.

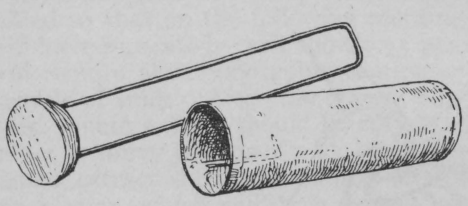

FIG. 27.—*Neufchâtel cheese mold*

TABLE 6. YIELD OF NEUFCHÂTEL CHEESE

Quantity of milk (pounds)	Percentage of fat in milk	Treatment	Acidity of milk when set (per cent)	Amount of starter used (cubic centimeters)	Amount of rennet used (cubic centimeters)	Temperature of milk when set (Fahrenheit)	Acidity of curd when dipped (per cent)	Temperature of curd when dipped (Fahrenheit)	Yield of cheese (pounds)	Pounds of cheese from 100 pounds of milk	Condition of cheese
25	3.0	Not pasteurized	0.16	1.0	0.5	72°	0.37	71°	4.75	19	.....
25	4.0		0.18	1.0	1.0	72°	0.40	70°	6.25	25	.....
25	4.0		0.16	1.0	0.3	72°	0.38	70°	6.25	25	.....
25	3.0		0.19	1.0	0.5	73°	0.50	70°	5.00	20	Acid
25	3.0		0.20	0.5	1.0	72°	0.39	71°	4.50	18	.....
25	3.0		0.19	1.0	0.5	72°	0.37	72°	5.00	20	.....
Average, 25	.....	.....	.....	.....	.....	.....	.....	.....	5.29	.....	.....
		Pasteurized at...									
25	3.0	145° F.	0.18	1.0	0.5	72°	0.41	70°	5.50	22	.....
25	3.0	155° F.	0.20	1.0	0.5	72°	0.44	69°	5.75	23	.....
25	3.0	180° F.	0.16	2.0	0.5	72°	0.38	71°	6.00	24	Pasty
Average, 25	.....	.....	.....	.....	.....	.....	.....	.....	5.75	.....	.....

Yield.—In table 6 is shown the yield of neufchâtel cheese that may be expected. The yield is seen to vary between wide limits, according to the amount of fat in the milk from which the cheese is made, the amount of moisture left in the curd, and whether or not the milk has been pasteurized. In table 7, giving the composition, a very high percentage of water is shown. It is easy, however, to press the cheese a little longer, thus changing both the composition and the yield.

TABLE 7. ANALYSIS OF NEUFCHÂTEL CHEESE*

	Percentage of					
	Water	Fat	Proteids amids, etc.	Milk sugar, lactic acid, etc.	Total ash	Casein
Balland (two analyses)	50.80	25.15	17.60	5.12	1.33	.....
	54.80	20.59	14.43	5.98	4.20	.....
Blyth	37.90	41.30	23.10	.....	3.40	.....
von Klenze	51.72	23.99	20.73	.....	3.56	.....
Martin (two analyses)	56.08	23.34	16.67	1.42	2.49	.....
	57.83	21.00	17.00	1.32	2.85	.....
Payen (two analyses)	34.47	41.91	13.03	6.96	3.63	.....
	36.58	40.71	14.18	9.02	0.51	.....
Arnold	37.45	34.60	24.04	.....	3.90	.....
Johnson	57.25	22.30	15.03	2.94	2.48	.....

*From Bulletin 105, U. S. Bureau of Animal Industry.

The figures in table 7 are taken from Bulletin 105 of the United States Bureau of Animal Industry. The composition of neufchâtel cheese as shown in this table varies between wide limits. This is undoubtedly due to the fact that there is no standard for the composition of neufchâtel, and so a cheese is made and called neufchâtel. The composition of the cheese made in the Department of Dairy Industry at Cornell University

TABLE 8. COMPOSITION OF NEUFCHÂTEL CHEESE

	I	II	III	IV	V	Average
Water	55.6	60.3	62.3	58.1	62.6	59.78
Fat	23.0	16.5	17.5	17.0	16.5	18.10
Protein	16.5	17.6	15.3	20.0	15.5	16.98
Acid (calculated as lactic acid)	1.9	2.0	2.0	2.1	1.8	1.96
Milk sugar	1.6	1.6	1.5	1.4	1.6	1.54
Ash	1.4	2.0	1.4	1.4	2.0	1.64

is shown in table 8. The cheese used in Analysis I was taken directly from the refrigerator, so that the percentage of fat in the milk is not exactly known. The cheese used in Analyses II, III, and V was made from milk containing 3 per cent fat, and the cheese used in Analysis IV was made from milk containing 2.8 per cent fat. The fat varies only between narrow limits in Analyses II, III, IV, and V, and the water content does not vary widely.

Qualities of neufchâtel cheese.—Neufchâtel cheese should have a distinct, mild, clean flavor, resembling the odor of freshly drawn milk. The texture should be fairly dry and smooth, with no hard, dry lumps nor grains. There should be no whey leaking from the cheese.

Neufchâtel curd forms the basis of a number of other varieties of cheese, made by mixing nuts, pimento, cream, and other substances with the curd.

CREAM CHEESE

Cream cheese can be made in either one of two ways — by mixing cream with neufchâtel curd, or by a method very similar to that used in making neufchâtel cheese except that cream testing 10 per cent fat is used instead of milk.

Method of manufacture using neufchâtel curd.—When cream is mixed with neufchâtel curd it is difficult to get cheese as rich as that obtained by making the curd from cream testing 10 per cent fat, because if too much cream is added to the neufchâtel curd it will become so moist, and usually so sticky, that it cannot be handled. One pound of heavy cream testing about 50 per cent fat, mixed with five pounds of neufchâtel curd, will ordinarily give a good grade of cream cheese. Care should be taken not to mix the curd so much that it will become salvy. Usually it will be necessary to add a little more salt to the cheese.

This method is much quicker and is less wasteful than making the cheese from cream testing 10 per cent fat.

Method of manufacture using 10-per-cent cream.—When cream testing 10 per cent fat is to be used in making cheese, the method is very similar to that for making neufchâtel cheese. The cream is placed in thirty-pound cans and brought to a temperature of 72° F., in the same way as for neufchâtel cheese, and the same degree of acidity is developed at the time of dipping. A greater quantity of rennet extract is used, this usually being about one cubic centimeter to thirty pounds of milk. This gives a quicker coagulation, thus preventing a loss of fat which would occur if the cream were allowed to rise before coagulation took place. The following morning the curd is dipped onto a cloth, and from this point on the method is the same as that used for neufchâtel.

With this method there is a considerable loss of fat, which is pressed out with the whey. For this reason the method is not extensively used.

Composition.—The cheese used in the analyses in table 9 was made from neufchâtel curd. The cheese used in Analysis I was taken directly from the refrigerator, so that the exact analyses of the milk and the cream were not known. The cheese used in Analyses II, III, and V were made from milk testing 3 per cent fat, and the milk from which the cheese used in Analysis IV was made contained 2.8 per cent fat. Two pounds of cream

was then mixed with the curd from thirty pounds of milk, except in the case of the cheese used in Analysis IV, in which 1.8 pounds of cream was mixed with the curd from thirty pounds of milk. The percentage of fat used in the cream was as follows: Analysis II, 58 per cent fat; Analysis III, 5 per cent fat; Analysis IV, 50 per cent fat; Analysis V, 42 per cent fat. From these figures it is seen that a small difference in the percentage of fat in the cream used has little effect on the fat content of the cheese, but the variation in water content has a greater effect.

TABLE 9. COMPOSITION OF CREAM CHEESE

	I	II	III	IV	V	Average
Water	57.5	50.8	49.6	52.8	50.8	52.30
Fat	23.4	33.0	33.5	28.0	31.5	29.88
Protein	13.6	11.7	12.4	14.9	13.7	13.26
Acid (calculated as lactic acid)	1.6	1.4	2.1	1.4	1.5	1.60
Milk sugar	1.8	1.8	1.0	1.7	1.2	1.50
Ash	2.1	1.3	1.4	1.2	1.3	1.45

Yield.—The yield of cream cheese is a little more than that of neufchâtel cheese, due to the extra fat. The average yield is from twenty-two to twenty-four pounds of cheese from one hundred pounds of 10-per-cent cream, or from the curd from one hundred pounds of milk made by the neufchâtel method with cream added.

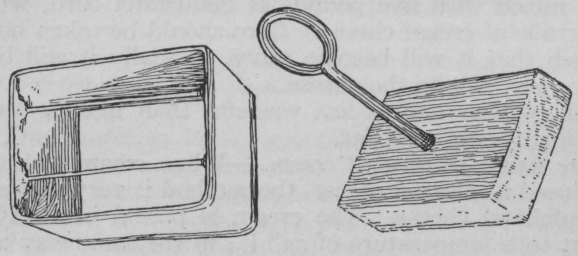

FIG. 28.—*Cream cheese mold*

Marketing.—Cream cheese is always put up in rectangular forms, measuring $1\frac{1}{4}$ by $2\frac{1}{2}$ by $2\frac{3}{4}$ inches. A tin mold used for pressing cream cheese is shown in figure 28. The cheeses weigh about one-fourth pound. They are wrapped in tin foil and put in boxes, twelve cheeses in a box.

Qualities of cream cheese.—Cream cheese should have a clean, mild, acid flavor, resembling well-ripened cream. It should be of a creamy consistency, but not salvy. It should not be grainy in texture, and there should be no hard, dry lumps.

PIMENTO CHEESE

Pimento cheese, which is much used for sandwiches, is made by adding pimentos to neufchâtel curd. A pound of pimentos is sufficient for from eight to ten pounds of curd.

Method of manufacture.—The pimentos are chopped very fine; this is best done by running them through a food chopper. They are then put

into the curd and thoroughly mixed through it. A small pinch of red pepper should be added, to give the cheese a pungent taste. The mixing can be more satisfactorily and evenly done if the pimentos are partly mixed with the cheese and then the whole mass is run through the food chopper. In order to do this and to be sure that the texture will not be salvy, the curd should be cold.

A better color can be obtained if cheese color is added to the milk from which the cheese is made, at the rate of one cubic centimeter of color to thirty pounds of milk. The color, which may be diluted with water or milk, should be added after the starter is added but before the rennet extract is put in.

Yield.—The yield of pimento cheese will be a little more than that of neufchâtel cheese, due to the added pimento; but there will be some loss of curd due to grinding.

Marketing.—Pimento cheese may be molded in either the neufchâtel or the cream cheese mold, and then wrapped in parchment or tin foil. Put up in this way, however, it does not keep very long. Many manufacturers are now putting the cheese into glass jars with screw tops, which hold from three to four ounces. In such a package the cheese will keep much longer, and the original package may be placed directly on the consumer's table and used as long as the cheese lasts. The glass jars are a little more expensive than the tin foil or the parchment paper, but the added expense is made up by the longer commercial life of the cheese.

Qualities of pimento cheese.—Pimento cheese should have a distinct but clean pimento flavor, with a biting taste. It should have a soft, but not salvy, texture, so that it can be evenly spread on bread and crackers. There should be no free whey dripping from the cheese.

CLUB CHEESE

Club cheese is known by a variety of names and is manufactured by many different methods. It is made largely from cheddar cheese, so that it is especially liked by persons who like the cheddar flavor or a strong cheese flavor. It has a soft texture so that it spreads easily, and is therefore much used for sandwiches.

Method of manufacture.—As stated already, there are many different methods of making club cheese. The method used by the Department of Dairy Industry at Cornell University is as follows:

Well-ripened or old cheddar cheese is ground in a food chopper and butter is mixed with it. The older the cheddar cheese, the stronger will be the flavor of the club cheese. Cheese and butter of good flavor should be used. The amount of butter to be used will depend on the amount of moisture in the cheese and the length of time the cheese is to be kept. If the cheese is dry, more butter should be put in, in order to make the texture soft; but if the cheese is to be kept for a long time, too much butter is likely to make it become rancid. Usually one pound of butter to eight or ten pounds of cheese is sufficient.

In order to do away with all lumps in the texture, it is sometimes necessary to run the mixed cheese and butter through the food chopper a second time. While all lumps must be worked out of the cheese, care

should be taken not to work the cheese so much that it will become salvy and sticky.

Usually a little pepper is added, to give the cheese a biting taste. Some manufacturers add a great variety of substances, but these are not necessary and destroy the flavor of the cheese.

Marketing.—Club cheese may be wrapped in tin foil or put up in air-tight glass jars. The latter practice, while more expensive, has the advantage of making the cheese keep longer; but for local trade tin foil is just as satisfactory as glass. In filling the glass care must be taken not to leave any air spaces between the cheese and the glass, as this is likely to cause the cheese to mold. A glass jar can be filled and air spaces prevented by first smearing a very thin layer of cheese over the glass.

SUMMARY

1. There is nothing in connection with the manufacture of soft cheeses which after a few trials the average cheese maker cannot master.

2. In order to have the best cheese possible there must be a supply of good milk.

3. A good starter must be used in connection with the cheese.

4. Soft cheeses can often be made and marketed in connection with butter making on the farm.

5. The commercial life of soft cheeses is so short that there must be an easily available and ready market.

6. While there is a large profit in the making of soft cheeses, there are so many losses that in many cases what appears to be a profit will be turned to a loss before the cheese can be sold.

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